IMPROVING MARS-GRAM: INCREASING THE ACCURACY OF SENSITIVITY STUDIES AT LARGE OPTICAL DEPTHS

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ABSTRACT

Extensively utilized for numerous mission applications, the Mars Global Reference Atmospheric Model (Mars-GRAM) is an engineering-level atmospheric model. In a Monte-Carlo mode, Mars-GRAM's perturbation modeling capability is used to perform high fidelity engineering end-to-end simulations for entry, descent, and landing (EDL). Mars-GRAM has been found to be inexact when used during the Mars Science Laboratory (MSL) site selection process for sensitivity studies for MapYear=0 and large optical depth values such as tau=3. Mars-GRAM is based on the NASA Ames Mars General Circulation Model (MGCM) from the surface to 80 km altitude. Mars-GRAM with the MapYear parameter set to 0 utilizes results from a MGCM run with a fixed value of tau=3 at all locations for the entire year. Imprecise atmospheric density and pressure at all altitudes is a consequence of this use of MGCM with tau=3. Density factor values have been determined for tau=0.3, 1 and 3 as a preliminary fix to this pressure-density problem. These factors adjust the input values of MGCM MapYear 0 pressure and density to achieve a better match of Mars-GRAM MapYear 0 with Thermal Emission Spectrometer (TES) observations for MapYears 1 and 2 at comparable dust loading. These density factors are fixed values for all latitudes and Ls and are included in Mars-GRAM Release 1.3. Work currently being done, to derive better multipliers by including variations with latitude and/or Ls by comparison of MapYear 0 output directly against TES limb data, will be highlighted in the presentation. The TES limb data utilized in this process has been validated by a comparison study between Mars atmospheric density estimates from Mars-GRAM and measurements by Mars Global Surveyor (MGS). This comparison study was undertaken for locations on Mars of varying latitudes, Ls, and LTST. The more precise density factors will be included in Mars-GRAM 2005 Release 1.4 and thus improve the results of future sensitivity studies done for large optical depths.